Low Level Design (LLD)

Energy Efficiency Analysis



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MANAKAVOO SIVA BALAJI

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**Contents**

Document Version Control 2

1. [Introduction 4](#_TOC_250006)
   1. [What is Low Level Design Document? 4](#_TOC_250005)
   2. Scope… 4
   3. [Project Introduction 4](#_TOC_250004)
2. [Problem Statement 5](#_TOC_250003)
3. [Dataset Information… 5](#_TOC_250002)
4. [Architecture… 6](#_TOC_250001)
   1. [Architecture Description 6](#_TOC_250000)

# Introduction

## What is Low Level Design Document?

#### The goal of the Low-level design document (LLDD) is to give the internal logic design of the actual program code for the Heart Disease Diagnostic Analysis dashboard. LLDD describes the class diagrams with the methods and relations between classes and programs specs. It describes the modules so that the programmer can directly code the program from the document.

* 1. **What is Scope?**

#### Low-level design (LLD) is a component-level design process that follows a step- by-step refinement process. The process can be used for designing data structures, required software architecture, source code and ultimately, performance algorithms. Overall, the data organization may be defined during requirement analysis and then refined during data design work.

## Project Introduction

With the increasing demand for energy and its environmental impact, energy efficiency in buildings has become a pressing concern. Inefficient heating and cooling systems, along with outdated designs, contribute to excessive energy consumption and greenhouse gas emissions. This project aims to use data-driven approaches to optimize energy use by analyzing the impact of building characteristics on heating and cooling loads. The goal is to develop models that predict heating load (HL) and cooling load (CL) based on building attributes, leading to more sustainable building practices and reduced energy costs.

# Problem Statement

The effect of eight input variables (relative compactness, surface area, wall area, roof area, overall height, orientation, glazing area, glazing area distribution) on two output variables, namely heating load (HL) and cooling load (CL), of residential buildings is investigated using a statistical machine learning framework. We have to use a number of classical and non-parametric statistical analytic tools to carefully analyze the strength of each input variable's correlation with each of the output variables in order to discover the most strongly associated input variables. We need to estimate HL and CL, we can compare a traditional linear regression approach to a sophisticated state-of-the-art nonlinear non-parametric method, random forests.

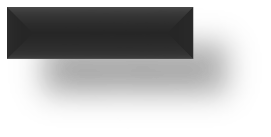
# Dataset Information

The dataset used in this project contains information about residential buildings and their heating load (HL) and cooling load (CL). The dataset includes the following variables:

1. **Relative Compactness:** The relative compactness of the building, ranging from 0.62 to 0.98.
2. **Surface Area:** The total surface area of the building, measured in square meters.
3. **Wall Area:** The total area of the walls of the building, measured in square meters.
4. **Roof Area:** The total area of the roof of the building, measured in square meters.
5. **Overall Height:** The overall height of the building, measured in meters.
6. **Orientation:** The orientation of the building (0, 90, 180, or 270 degrees).
7. **Glazing Area:** The total area of the windows in the building, measured in square meters.
8. **Glazing Area Distribution:** The distribution of the glazing area among different sides of the building (0, 1, 2, or 3).

The dataset contains a total of 768 samples, each representing a different building. The dataset is divided into a training set and a test set, with 70% of the samples used for training and 30% used for testing.

# Architecture



Real World

Exploratory Data Analysis (EDA)

Modelling

Deployment

Data Cleaning

Data Pre- Processing

Raw Data Collection

Reporting

* 1. **Architecture Description**

The architecture for this project involves the use of a statistical machine learning framework to investigate the effect of eight input variables on the heating load (HL) and cooling load (CL) of residential buildings. The architecture consists of the following components:

1. **Data Collection:** The Dataset was taken from iNeuron’s Provided Project Description Document. <https://drive.google.com/file/d/15ZovBbQIWTPvtsreGoK0NklS6YFENt8L/view?usp=sharing>
2. **Data Preprocessing:** Clean the data by handling missing values, outliers, and ensuring the data is in the correct format for analysis.
3. **Feature Selection:** Use classical and non-parametric statistical analytic tools to analyze the strength of each input variable's correlation with each of the output variables (HL and CL).
4. **Model Selection and Comparison:**
   1. Linear Regression: Use a traditional linear regression approach to estimate HL and CL based on the input variables.
   2. Random Forests: Use a sophisticated state-of-the-art nonlinear non-parametric method like random forests to estimate HL and CL.
5. **Model Evaluation:** Evaluate the performance of both models using appropriate metrics (e.g., mean squared error, R-squared) to compare their accuracy in estimating HL and CL.
6. **Result Analysis:** Analyze the results to determine which model (linear regression or random forests) performs better in estimating HL and CL based on the input variables
7. **Reporting**

Reporting is a most important and underrated skill of a data analytics field. Because being a Data Analyst you should be good in easy and self- explanatory report because your model will be used by many stakeholders who are not from technical background.

* + - 1. High Level Design Document (HLD)
      2. Low Level Design Document (LLD)
      3. Architecture
      4. Wireframe
      5. Detailed Project Report
      6. Power Point Presentation

1. **Deployment**: We created a Power BI

